
Emergence of the Next “World Wide Web”
International Development: Statement of Need

- UN World Food Program Report (Feb. 17, 2007)
- 850 million people are “hungry or malnourished”
- Half of this number are children
- 18,000 children die of starvation every single day
Worldwide Hunger: 18,000 Children Die Every Day

Compared to Stanford University Student Enrollment

- Undergraduate Students: 6,422
- Graduate Students: 11,325
- Total Enrollment, Stanford: 17,747
Concept of Global Energy Network

- Connect regional electricity grids into worldwide energy network
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The Global Energy Network

- Connect regional electricity grids into worldwide energy network
- Connect renewable energy resources (hydro, solar, wind)
- Phase out energy generating plants causing greatest pollution
- Provide universal access to electricity
- 2,000 kWh per capita/year
The Global Energy Network

- Proposed by Dr. R. Buckminster Fuller, inventor of Geodesic Dome
- First suggested at World Game simulation workshops in 1970's
Dr. R. Buckminster Fuller
Special Collections, Stanford University Library

Welcome

The Stanford University Libraries, in association with the Estate of R. Buckminster Fuller, welcome you to this digital collection designed to support use and study of the audio-visual materials from the historic Fuller Collection at Stanford University.

The R. Buckminster Fuller Collection documents the life and work of this 20th century polymath, and contains his personal archive, correspondence, manuscripts, drawings and audio-visual materials relating to his career as an architect, mathematician, inventor and social critic.

The audio and video selections in this particular collection have been digitally reformatted and preserved with the generous support of Save America's Treasures, a federally-administered grant program supported by the National Park Service and the National Trust for Historic Preservation.

World Game
Simulation Workshops

• Conducted at colleges and corporations in 1970’s
• Simulation exercises - opposite of “war games”
• War games prepare for war; world games prepare for peace
• World Game Objective:
  • “How can we make the world work...
    for 100% of humanity...
    in the shortest possible time...
    through spontaneous cooperation...
    without ecological damage or...
    disadvantage to anyone?”
• Highest priority strategy:  Global Energy Grid
The Global Energy Network:
Potential Benefits

- Turn back the clock on global warming
- Universal increase in living standards
- Reduction in hunger and poverty
- Stabilize population growth
- Increase in trade, cooperation and peace between nations
Unique Properties of Electricity

- Basis of civilization – access to electricity sets standard of living
- Fastest way to balance earth’s “energy accounts” – travels at the speed of light
- Can’t be easily stored
- Used on a time-sensitive basis (peak vs. off-peak)
Electricity: Basis of Civilization

- **Developed** world: 2,000+ kWh per capita
- **Developing** world: 1,000 – 2,000 kWh per capita
- **Poverty**: Less than 1,000 kWh per capita
Electricity: Basis of Civilization

- Current world population
  6.5 Billion people

- People with no access to electricity:
  2 Billion people
Electricity: Basis of Civilization

- Clean drinking water and adequate water treatment systems
- Refrigeration: stable food supply and medicines
- Reduction of disease and infant mortality
- Improved standard of living: stable population growth
- Correlates with high literacy rate
- Stable economy with steady job growth
Electricity: Supply vs. Demand
Fastest Way to Balance Earth Energy Accounts

- Earth’s Daily Energy Input: 174,000 Terawatts
- Earth’s Daily Energy Needs: 13.4 Terawatts
- Every day, Earth receives 12,000 times as much energy as civilization uses
Electricity: Supply vs. Demand

Fastest Way to Balance Earth Energy Accounts

- Energy Not Always...
  - the right kind of energy
  - at the right place
  - at the right time...

- Not a supply problem, but a distribution problem

- Electricity travels at speed of light

- Only commodity that can be traded, delivered and used immediately

GENI Global Energy Network Institute

TerraWatts.com
Electricity: Time-Sensitive Demand

- Electricity needs change throughout the day
- Peak needs only occur briefly during day
- Avg needs usually $\frac{1}{2}$ what peak needs are
- Baseload needs usually $\frac{1}{2}$ again as small
- Large amounts of energy wasted as generating facilities are started and stopped during the day
Option 1: Power Plants Respond to Peak Demand

- Power plants produce:
  - 59% of sulfur dioxide
  - 18% of nitrogen oxide
  - 40% of carbon dioxide

- Over half use coal
Option 2: Electricity Energy Transfers

- Bulk power transfer more efficient than transient generation
- Over 35% of all energy sold now bulk power transfer
Electricity Meets Changing Global Needs
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Energy Transmission Limits?

- Up until 1930’s, transmission limit was 350 miles.
Electricity Transmission Limits
Energy Transmission Limits?

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- New technology in 1960’s increased this limit to 1,500 miles.
Electricity Transmission Limits

Transmission Limits:
Year Limit
1930 350 mi.
1960 1500 mi.
1994 4300 mi.
Energy Transmission Limits?

• Up until 1930’s, transmission limit was 350 miles.

• New technology in 1960’s increased this limit to 1,500 miles.

• UHV and HVDC technology now allow bulk power transfers of more than 4,300 miles.
Electricity Transmission Limits
Pacific-Southwest Intertie

- High Voltage (500kV) DC Line
- Enough power to serve 2-3 million LA households
- Completed in 1972, upgraded in 1984 and 2004
- Connects Bonneville hydro power in NW to Southern California
- Line extends about 900 miles
Electric Utility Industry Barriers

- Highly regulated for past 100+ years
- Fragmented, regional utility service areas
- Little or no incentive to invest in new transmission infrastructure
- No over-arching global strategy
Global Energy Grid: Largely Built

Red lines indicate portions of the grid which have not yet been completed.
Yellow lines indicate generalized portions of the grid which are complete today.
Asia Pacific Rim Electricity Cooperation

- Proposed by Hitachi Research Institute in 1998
- Interconnect Pacific Rim nations with UHV and HVDC lines
- Flatten demand curve across multiple time zones
- Flatten out seasonal demands between tropical and high-latitude climates
East-West Energy Bridge

- Symbolic connection across International Date Line
East-West Energy Bridge

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- Would connect North America with Siberia across the Bering Straits
East-West Energy Bridge

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- Would connect North America with Siberia across the Bering Straits
- Connection to Diomede Island midpoint is 26 miles
East-West Energy Bridge

- Symbolic connection across International Date Line
- Would connect North America with Siberia across the Bering Straits
- Connection to Diomede Island midpoint is 26 miles
- Leg to Siberian mainland is just 22 miles
Former Soviet Union Time Zones

USSR: Time Zones

International Time Zone
-4 hrs. Number of hours ahead of Greenwich Mean Time (GMT = 0)
(+4 hrs.) Number of hours ahead of GMT
15 April – 1 October
8 hrs. Number of hours ahead of Moscow Time

USSR-USA Time Difference Calculator

Daylight Saving Time

THE UNIVERSITY OF TEXAS AT AUSTIN


Note: Based on standard practices, schedules are

3 hrs. Standard time plus 1 hour, South Sunday in April
4 hrs. Standard time plus 1 hour, North Sunday in September
Global Energy Network Endorsements

- Walter Cronkite
- Al Gore
- Boutros Boutros-Ghali
- His Holiness Dalai Lama
- Rev. Desmond Tutu
- Vincente Fox
- Jonas Salk
- Senator Tim Wirth
- Senator Jim Jeffords
- Senator Alan Cranston
- Dr. Oscar Arias
Grid-Building in 2006

- Russia and China agree to interconnect
- China also sign deals with Vietnam and Tajikistan
- South Korea offers to extend grid into North Korea
- Kenya and Ethiopia agree to supply power to each other
- Modeled after 12-nation South Africa Power Pool, 14 west Africa nations plan to link their energy grids
Grid-Building in 2006

- Lebanon to be linked to regional grid that includes Egypt, Jordan, Syria and Turkey
- Same project will join Libya and Iraq
- Former enemies Iran and Iraq agreed to build four cross-border power lines
- Mexico’s *Mesoamerica Initiative* plans to integrate energy grids of all of the Central American nations
Trends Supporting Grid Growth

Technical

• UHV and HVDC technology
• Superconducting transmission lines
  • Zero resistance, zero power loss
• “Smart Grid” strategies:
  • Interactive energy management
  • Robust data transmission
  • Real time pricing and communications between producers and consumers
  • Improved reliability
• National Grid Week: April 23-26
Trends Supporting Grid Growth

**Economical**

- High risk, cost of plant construction
- M/A activity among utility firms
- Growth of Distributed Generation
- Growth in Renewable Energy
Micro-Generation: Home Solar

- California Solar Initiative adding thousands of small to medium-size solar energy systems

- "Net Metering" Program:
  - During day, homes spin meter backwards, selling power back to grid
  - At night, homes "buy back" power sold during the day

- Each of these solar homes are new nodes on the energy grid

- Electricity connection into house is now a 2-way pipe
Long-Range Consequences

• Growth in renewable energy “pro-sumers”
• Aggregators seeking contracts on blocks of solar, wind and fuel cell-generated “premium power”
• New industry: Hardware and software for energy management and energy transactions
• “Peer-to-Peer” energy trading over longer distances
• Direct, individual participation in the global economy
The Energy Challenge

"Where there is no vision, the people perish."
Proverbs 29:18
The Future Energy Vision

- A homeowner in San Jose will capture kilowatts for sale to a homeowner in Shanghai
- Instead of running all of the world’s generators half the time... we will run half the world’s generators all the time.
- Successful phase out of fossil fuels
- Reversal of climate change
- Universal access to electricity... and a reasonable standard of living, world-wide
Thank You.

For more information...

www.geni.org